

## CHAPTER 80 APPLICATION OF DESIGN STANDARDS

### Topic 81 - Project Development Overview

#### Index 81.1 - Philosophy

The Project Development process seeks to provide a degree of mobility to users of the transportation system that is in balance with other values. In the development of transportation projects, social, economic, and environmental effects must be considered fully along with technical issues so that final decisions are made in the best overall public interest. Attention should be given to such considerations as:

- (a) Need for safe and efficient transportation.
- (b) Attainment of community goals and objectives.
- (c) Needs of low mobility and disadvantaged groups.
- (d) Costs of eliminating or minimizing adverse effects on natural resources, environmental values, public services, aesthetic values, and community and individual integrity.
- (e) Planning based on realistic financial estimates.
- (f) The cost, ease, and safety of maintaining whatever is built.

Proper consideration of these items requires that a facility be viewed from the perspectives of the user, the nearby community, and larger statewide interests. For the user, efficient travel and safety are paramount concerns. At the same time, the community often is more concerned about local aesthetic, social, and economic impacts. The general population, however, tends to be interested in how successfully a project functions as part of the overall transportation system and how large a share of available capital resources it consumes. Therefore, individual projects must be selected

for construction on the basis of overall system benefits as well as community goals, plans, and values.

Decisions must also emphasize different transportation modes working together effectively.

The goal is to increase highway mobility and safety in a manner that is compatible with, or which enhances, adjacent community values and plans.

### Topic 82 - Application of Standards

#### 82.1 Highway Design Manual Standards

- (1) *General.* The highway design criteria and policies in this manual provide a guide for the engineer to exercise sound judgment in applying standards, consistent with the above Project Development philosophy, in the design of projects.

The design standards used for any project should equal or exceed the minimum given in the Manual to the maximum extent feasible, taking into account costs, traffic volumes, traffic and safety benefits, right of way, socio-economic and environmental impacts, etc. The philosophy provides for use of lower standards when such use best satisfies the concerns of a given situation. Because design standards have evolved over many years, many existing highways do not conform fully with current standards. It is not intended that current manual standards be applied retroactively to all existing State highways; such is neither warranted nor economically feasible. However, when warranted, upgrading of existing roadway features such as guardrail, lighting, superelevation, roadbed width, etc., should be considered, either as independent projects or as part of larger projects. A record of the decision not to upgrade the existing non-standard mandatory features shall be provided through the exception process (See Index 82.2).

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This manual does not address temporary construction features. It is recognized that the construction conditions encountered are so diverse and variable that it is not practical to set geometric criteria. Guidance for the treatment of temporary construction zones can be found in Chapter 5 of the Traffic Manual, "Manual of Traffic Control" and the Manual on Uniform Traffic Control Devices (MUTCD).

In this manual design standards are categorized in order of importance in development of a safe State highway system operating at selected levels of service commensurate with projected traffic volumes and highway classification.

- (2) *Mandatory Standards.* Mandatory design standards are those considered most essential to achievement of overall design objectives. Many pertain to requirements of law or regulations such as those embodied in the FHWA's 13 controlling criteria (see below). Mandatory standards use the word "shall" and are printed in **Boldface** type (see Table 82.1A).
- (3) *Advisory Standards.* Advisory design standards are important also, but allow greater flexibility in application to accommodate design constraints or be compatible with local conditions on resurfacing or rehabilitation projects. Advisory standards use the word "should" and are indicated by Underlining (see Table 82.1B).
- (4) *Permissive Standards.* All standards other than mandatory or advisory, whether indicated by the use of "should" or "may", are permissive with no requirement for application intended.
- (5) *Controlling Criteria.* The FHWA has designated thirteen controlling criteria for selection of design standards of primary importance for highway safety, listed as follows: design speed, lane width, shoulder width, bridge width, horizontal alignment, vertical alignment, grade, stopping sight distance, cross slope, superelevation, horizontal clearance, vertical clearance and bridge structural

capacity. All but the last of these criteria are also designated as geometric criteria.

The design standards related to the 12 geometric criteria are designated as mandatory standards in this manual (see Index 82.1(2) and Table 82.1A).

- (6) *Other.* In addition to the design standards in this manual, the Traffic Manual contains standards relating to clearzone, signs, delineation, barrier systems, signals, and lighting.

Caution must be exercised when using other Caltrans publications which provide guidelines for the design of highway facilities, such as HOV lanes. These publications do not contain design standards; moreover, the designs suggested in these publications do not always meet Highway Design Manual Standards. Therefore, all other Caltrans publications must be used in conjunction with this manual.

## 82.2 Approvals for Nonstandard Design

- (1) *Mandatory Standards.* **To promote uniform practice on a statewide basis, design features or elements which deviate from the mandatory standards indicated herein shall require the approval of the Chief, Division of Design. This approval authority has been delegated to the Design Coordinators, except the mandatory standards in Chapter 600, which have been delegated to the Chief, Office of Pavement Design, and may involve coordination with the Design Coordinator.**

The current procedures and documentation requirements pertaining to the approval process for exceptions to mandatory design standards are contained in Chapter 21 of the Project Development Procedures Manual (PDPM).

Design exception approval must be obtained prior to District approval of the PSR, or any project initiation document (i.e., PSSR, PEER, combined PSR/PR), other than the PSR-PDS. The text of the project initiation report must include a brief description of the nonstandard

features, as well as a reference to all approved Fact Sheets and their approval dates by the Division of Design and/or FHWA (when applicable).

If the need for a design exception is identified after approval of the project's initiation document, the above described consultation and documentation process shall be initiated immediately, and must be completed prior to approval of the next project development report. The text of the project development report (i.e., Draft Project Report, Project Report, Supplemental PR, PAR, etc.) must include the design exception reference normally provided in the project initiation report (see above).

During the construction phase of a project, Fact Sheets must be prepared (by Project Development staff) to document any nonstandard features proposed in a Contract Change Order. Such Change Orders shall not be executed until the proposed design exception has been approved (at least verbally) by the appropriate Caltrans and FHWA (if required) authority (ies). If verbal approval is granted to expedite Change Order execution, the Fact Sheet must be completed and approved immediately thereafter.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) allows significant delegation to the states by FHWA to approve and administer portions of the Federal-Aid Transportation Program. California has accepted the maximum delegations offered as outlined in the May 27, 1992 memorandum signed by W.P. Smith. If required, FHWA approval of exceptions to mandatory design standards related to the 13 controlling criteria should be sought as early in the project development process as possible. However, formal approval shall not be requested until the appropriate Project Development Coordinator has approved the design exception.

FHWA approval is not required for exceptions to "Caltrans-only" mandatory standards. Table 82.1A identifies these mandatory standards.

For local facilities crossing the State right of way see Index 308.1.

- (2) *Advisory Standards.* The authority to approve exceptions to advisory standards has been delegated to the District Directors. Proposals for exceptions from advisory standards should be discussed with the Project Development Coordinators during development of the approval documentation. The responsibility for the establishment of procedures for review, documentation, and long term retention of approved exceptions from advisory standards has also been delegated to the District Directors.

### 82.3 Use of FHWA and AASHTO Standards and Policies

The standards in this manual generally conform to the standards and policies set forth in the AASHTO publications, "A Policy on Geometric Design of Highways and Streets" (2001) and "A Policy on Design Standards-Interstate System" (1988). A third AASHTO publication, "Roadside Design Guide" (2002), focuses on creating safer roadsides. These three documents, along with other AASHTO and FHWA publications cited in 23 CFR Ch 1, Part 625, Appendix A, contain most of the current AASHTO policies and standards, and are approved references to be used in conjunction with this manual.

AASHTO policies and standards, which are established as nationwide standards, do not always satisfy California conditions. When standards differ, the instructions in this manual govern, except when necessary for FHWA project approval (Index 108.3, Coordination with the FHWA).

### 82.4 Mandatory Procedural Requirements

Required procedures and policies for which Caltrans is responsible, relating to project clearances, permits, licenses, required tests, documentation, value engineering, etc., are indicated by use of the word "must". Procedures and actions to be performed by others (subject to notification by Caltrans), or statements of fact are indicated by the word "will".

### **82.5 Effective Date for Implementing Revisions to Design Standards**

Revisions to design standards will be issued with a stated effective date. It is understood that all projects will be designed to current standards unless an exception has been approved in accordance with Index 82.2.

On projects where the project development process has started, the following conditions on the effective date of the new or revised standards will be applied:

- For all projects where the PS&E has not been finalized, the new or revised design standards shall be incorporated unless this would impose a significant delay in the project schedule or a significant increase in the project engineering or construction costs. The Project Development Coordinator will make the final determination on whether to apply the new or previous design standards on a project-by-project basis for roadway features.
- For all projects where the PS&E has been submitted to Headquarters Office Engineer for advertising or the project is under construction, the new or revised standards will be incorporated only if they are identified in the Change Transmittal as requiring special implementation.

For locally-sponsored projects, the Oversight Engineer shall inform the funding sponsor within 15 working days of the effective date of any changes in mandatory or advisory design standards as defined in Index 82.2.

**Table 82.1A**  
**Mandatory Standards**

<b>CHAPTER 80</b>	<b>APPLICATION OF DESIGN STANDARDS</b>	204.8	Vertical Falsework Clearances*
<b>Topic 82</b>	Application of Standards	<b>Topic 205</b>	<b>Road Connections and Driveways</b>
Index 82.2	Approvals for Nonstandard Design	Index 205.1	Sight Distance Requirements for Access Openings on Expressways
<b>CHAPTER 100</b>	<b>BASIC DESIGN POLICIES</b>	<b>Topic 208</b>	<b>Bridges and Grade Separation Structures</b>
<b>Topic 101</b>	<b>Design Speed</b>	Index 208.1	Bridge Width
Index 101.1	Technical Reductions of Design Speed	208.10	Bridge Approach Railings*
101.1	Selection of Design Speed - Local Facilities	<b>CHAPTER 300</b>	<b>GEOMETRIC CROSS SECTION</b>
101.1	Selection of Design Speed - Local Facilities - with Connections to State Facilities	<b>Topic 301</b>	<b>Pavement Standards</b>
101.2	Design Speed Standards	Index 301.1	Lane Width
<b>Topic 104</b>	<b>Control of Access</b>	301.2	Cross Slopes
Index 104.4	Protection of Access Rights*	301.2	Algebraic Differences in Cross Slopes
<b>CHAPTER 200</b>	<b>GEOMETRIC DESIGN AND STRUCTURE STANDARDS</b>	<b>Topic 302</b>	<b>Shoulder Standards</b>
<b>Topic 201</b>	<b>Sight Distance</b>	Index 302.1	Shoulder Width
Index 201.1	Sight Distance Standards	302.2	Shoulder Cross Slopes
<b>Topic 202</b>	<b>Superelevation</b>	<b>Topic 305</b>	<b>Median Standards</b>
Index 202.2	Standards for Superelevation	Index 305.1	Median Width*
202.7	Superelevation on City Streets and County Roads	<b>Topic 307</b>	<b>Cross Sections for State Highways</b>
<b>Topic 203</b>	<b>Horizontal Alignment</b>	Index 307.2	Shoulder Width for Structural Section Support on Two-lane Cross Sections for New Construction
Index 203.1	Horizontal Alignment - Local Facilities	307.2	Shoulder Standards for Two-lane Cross Sections for New Construction
203.1	Horizontal Alignment and Stopping Sight Distance	<b>Topic 308</b>	<b>Cross Sections for Roads Under Other Jurisdictions</b>
203.2	Standards for Curvature	Index 308.1	Cross Section Standards for City Streets and County Roads without Connection to State Facilities
<b>Topic 204</b>	<b>Grade</b>	308.1	Minimum Width of 2-lane Structures for City Streets and County Roads without Connection to State Facilities
Index 204.1	Standards for Grade - Local Facilities		
204.3	Standards for Grade		

\* Caltrans-only Mandatory Standard

**Table 82.1A**  
**Mandatory Standards (Cont.)**

<b>Topic 309</b>		<b>CLEARANCES</b>	<b>CHAPTER 500</b>	<b>TRAFFIC INTERCHANGES</b>
Index 308.1		Cross Section Standards for City Streets and County Roads with Connection to State Facilities	<b>Topic 501</b>	<b>General</b>
308.1		Minimum Width of 2-lane Structures for City Streets and County Roads with Connection to State Facilities	Index 501.3	Interchange Spacing
<b>Topic 310</b>		<b>FRONTAGE ROADS</b>	<b>Topic 504</b>	<b>Interchange Design Standards</b>
Index 309.1		Horizontal Clearances and Stopping Sight Distance	Index 504.2	Location of Freeway Entrances & Exits
309.1		Clear Recovery Zone	504.2	Ramp Deceleration Lane and "DL" Distance
309.2		Vertical Clearances - Major Structures	504.3	Ramp Lane Width
309.2		Vertical Clearances - Minor Structures	504.3	Ramp Shoulder Width
309.2		Rural and Single Interstate Routing System	504.3	Ramp Lane Drop Taper
309.3		Horizontal Tunnel Clearances	504.3	Ramp Metering Design Features
309.3		Vertical Tunnel Clearances	504.3	Lane Drop Taper
309.4		Lateral Clearance for Elevated Structures*	504.3	Ramp Meters on Connector Ramps
309.5		Structures Across or Adjacent to Railroads - Vertical Clearance	504.3	Lane Drop Transitions on Connector Ramps
<b>Topic 310</b>		<b>FRONTAGE ROADS</b>	504.3	Distance Between Ramp Intersection and Local Road Intersection
Index 310.1		Frontage Road Width*	504.4	Freeway-to-freeway Connections - Shoulder Width
<b>CHAPTER 400</b>		<b>INTERSECTIONS AT GRADE</b>	504.8	Access Control along Ramps
<b>Topic 405</b>		<b>Intersection Design Standards</b>	504.8	Access Control at Ramp Terminal
Index 405.1		Driver Set Back	504.8	Access Rights Required Opposite Ramp Terminals
405.1		Sight Distance at Public Road Intersections	<b>CHAPTER 600</b>	<b>PAVEMENT STRUCTURAL SECTION</b>
405.1		Sight Distance at Private Road Intersections	<b>Topic 602</b>	<b>Pavement Service Life and Traffic Data</b>
405.2		Left-turn Channelization - Lane Width	Index 602.2	Pavement Service Life for CAP-M*
405.2		Two-way Left-turn Lane Width	Index 602.2	Pavement Service Life for Pavement Rehabilitation*
405.3		Right-turn Channelization - Width	Index 602.2	Project Resurfacing Requirements*

\* Caltrans-only Mandatory Standard

**Table 82.1A**  
**Mandatory Standards (Cont.)**

<b>Topic 603</b>	Index 602.2	Pavement Service Life for New Construction & Reconstruction*	1003.1	Physical Barriers Adjacent to Class I Bikeways
	Index 602.2	Pavement Service Life for Widening*	1003.1	Class I Bikeway in Medians*
		<b>Portland Cement Concrete Pavement Structural Section Design</b>	1003.1	Class I Bikeway Design Speeds*
	Index 603.2	Doweling and Tying Concrete Pavement*	1003.1	No Speed Bumps on Class I Bikeways*
	Index 603.4	Shoulder Structural Section Requirements*	1003.2	Class II Bikeway Design*
<b>CHAPTER 700</b>		<b>MISCELLANEOUS STANDARDS</b>	1003.2	Class II Bikeway Widths Adjacent to Parking Stalls*
<b>Topic 701</b>		<b>Fences</b>	1003.2	Class II Bikeways Adjacent to Parking*
	Index 701.2	Fences on Freeways and Expressways*	1003.2	Class II Bikeway Widths where Parking is Permitted*
<b>CHAPTER 900</b>		<b>LANDSCAPE ARCHITECTURE</b>	1003.2	Class II Bikeway Widths where Parking is Prohibited*
<b>Topic 903</b>		<b>Safety Roadside Rest Area Design Standards</b>	1003.2	Class II Bikeways Adjacent to Part-time Parking*
	Index 903.5	Rest Area Ramp Design	1003.2	Class II Bikeways Widths in Undeveloped Areas*
<b>Topic 904</b>		<b>Vista Point Standards and Guidelines</b>	1003.2	Class II Bikeways Delineation*
	Index 904.3	Vista Point Ramp Design	1003.2	Class II Bikeways Through Interchange*
<b>CHAPTER 1000</b>		<b>BIKEWAY PLANNING AND DESIGN</b>	1003.3	Class III Bikeways Through Interchange*
<b>Topic 1002</b>		<b>General Planning Criteria</b>	1003.6	Bicycles Traveling against Traffic*
	Index 1002.1	Resurfacing Requirements*	1003.6	Bikeway Overcrossing Structures*
	1002.1	Shoulder Requirements when Adding Lanes*	1003.6	Drainage Inlet Grates on Bikeways*
<b>Topic 1003</b>		<b>Design Criteria</b>	<b>Topic 1004</b>	
	Index 1003.1	Class I Bikeway Widths*	<b>Uniform Signs, Markings and Traffic Control Devices</b>	
	1003.1	Class I Bikeway Horizontal Clearance*	Index 1004.1	Uniform Signs, Markings and Traffic Control Devices*
	1003.1	Class I Bikeway Structure Width*	1004.3	Class II Bikeway Signing*
	1003.1	Class I Bikeway Vertical Clearance*	1004.3	Class II Bikeway Pavement Markings*
			1004.3	Class II Bikeway Pavement Markers*

\* Caltrans-only Mandatory Standard

**Table 82.1A**  
**Mandatory Standards (Cont.)**

<b>CHAPTER 1100</b>	<b>HIGHWAY TRAFFIC NOISE ABATEMENT</b>
<b>Topic 1102</b>	<b>Design Criteria</b>
Index 1102.2	Horizontal Clearance to Noise Barrier
1102.2	Noise Barrier on Safety Shape Concrete Barrier

**Table 82.1B**  
**Advisory Standards**

<b>CHAPTER 100</b>		<b>BASIC DESIGN POLICIES</b>		<b>Topic 203</b>	<b>Horizontal Alignment</b>
<b>Topic 101</b>		<b>Design Speed</b>		Index 203.1	Horizontal Alignment - Local Facilities
Index	101.1	Selection of Design Speed - Local Facilities		203.3	Alignment Consistency and Design Speed
	101.1	Selection of Design Speed - Local Facilities - with Connections to State Facilities		203.5	Compound Curves
				203.6	Reversing Curves
<b>Topic 104</b>		<b>Control of Access</b>		<b>Topic 204</b>	<b>Grade</b>
Index	104.5	Relation of Access Opening to Median Opening		Index 204.1	Standards for Grade - Local Facilities
<b>Topic 105</b>		<b>Pedestrian Facilities</b>		204.3	Standards for Grade
Index	105.1	Minimum Sidewalk Width		204.3	Ramp Grades
	105.4	New Construction, Two Ramp Design		204.4	Vertical Curves
<b>Topic 107</b>		<b>Roadside Installations</b>		204.5	Decision Sight Distance at Climbing Lane Drops
Index	107.1	Standards for Roadway Connections		204.6	Design Speeds for Horizontal and Vertical Curves
	107.1	Number of Exits and Entrances Allowed at Roadway Connections		204.8	Falsework Span and Depth Requirements
<b>CHAPTER 200</b>		<b>GEOMETRIC DESIGN AND STRUCTURE STANDARDS</b>		<b>Topic 205</b>	<b>Road Connections and Driveways</b>
<b>Topic 201</b>		<b>Sight Distance</b>		Index 205.1	Access Openings on Expressways
Index	201.3	Stopping Sight Distance on Grades		<b>Topic 206</b>	<b>Pavement Transitions</b>
	201.7	Decision Sight Distance		Index 206.3	Lane Drop Transitions
<b>Topic 202</b>		<b>Superelevation</b>		206.3	Lane Width Reductions
Index	202.2	Superelevation on Same Plane for Rural Two-lane Roads		<b>Topic 208</b>	<b>Bridges and Grade Separation Structures</b>
	202.5	Superelevation Transition		Index 208.3	Decking of Bridge Medians
	202.5	Superelevation Runoff		208.6	Minimum Width of Pedestrian Overcrossings
	202.5	Superelevation in Restrictive Situations		208.10	Protective Screening on Overcrossings
	202.6	Superelevation of Compound Curves		208.10	Bicycle Railing Locations
	202.7	Superelevation on City Streets and County Roads		<b>Topic 210</b>	<b>Earth Retaining Systems</b>
				Index 210.5	Cable Railing

**Table 82.1B**  
**Advisory Standards (Cont.)**

<b>CHAPTER 300</b>		<b>GEOMETRIC CROSS SECTION</b>	<b>CHAPTER 400</b>		<b>INTERSECTIONS AT GRADE</b>
<b>Topic 301</b>		<b>Pavement Standards</b>	<b>Topic 403</b>		<b>Principles of Channelization</b>
	Index 301.2	Algebraic Differences of Cross Slopes		Index 403.3	Angle of Intersection
<b>Topic 303</b>		<b>Curbs, Dikes, and Side Gutters</b>	<b>Topic 404</b>		<b>Design Vehicles</b>
	Index 303.1	Use of Curb with Operating Speeds of 75 km/h and Greater		Index 404.3	STAA Truck-turn Template
	303.1	Selection of Curb Type		404.3	California Truck-turn Template
	303.3	Selection of Dike Type	<b>Topic 405</b>		<b>Intersection Design Standards</b>
<b>Topic 304</b>		<b>Side Slopes</b>		Index 405.1	Corner Sight Distance at Public Road Intersections
	Index 304.1	Side Slopes 1:4 or Flatter		405.1	Decision Sight Distance at Intersections
	304.1	5.5 m Minimum Catch Distance		405.5	Emergency Openings and Sight Distance
<b>Topic 305</b>		<b>Median Standards</b>		405.5	Median Opening Locations
	Index 305.1	Median Width	<b>CHAPTER 500</b>		<b>TRAFFIC INTERCHANGES</b>
	305.2	Median Cross Slopes	<b>Topic 502</b>		<b>Interchange Types</b>
<b>Topic 308</b>		<b>Cross Sections for Roads Under Other Jurisdictions</b>		Index 502.2	Isolated Ramps and Partial Interchanges
	Index 308.1	Cross Section Standards for City Streets and County Roads without Connection to State Facilities	<b>Topic 504</b>		<b>Interchange Design Standards</b>
	308.1	Minimum Shoulder Width Requirements for Bicycles		Index 504.2	Freeway Entrance and Exit Design
<b>Topic 309</b>		<b>Clearances</b>		504.2	Collector-distributor Deceleration Lane and "DL" Distance
	Index 309.1	Clear Recovery Zone		504.2	Paved Width at Gore
	309.1	Safety Shaped Barriers at Retaining, Pier, or Abutment Walls		504.2	Auxiliary Lanes
	309.5	Structures Across or Adjacent to Railroads - Vertical Clearance		504.2	Freeway Exit Design Speed
<b>Topic 310</b>		<b>Frontage Roads</b>		504.2	Decision Sight Distance at Exits
	Index 310.2	Outer Separation - Urban Areas		504.2	Design Speed and Alignment Consistency at Inlet Nose
	310.2	Outer Separation - Rural Areas		504.2	Freeway Ramp Grades
				504.2	Differences in Pavement Cross Slopes at Freeway Entrances and Exits
				504.2	Vertical Curves at Freeway Exits
				504.2	Crest Vertical Curves at Freeway Exit Terminal

**Table 82.1B**  
**Advisory Standards (Cont.)**

504.2	Sag Vertical Curves at Freeway Exit Terminal	504.4	Merging Branch Connector Auxiliary Lanes
504.2	Ascending Entrance Ramps with Sustained Upgrades	504.4	Diverging Branch Connector Auxiliary Lanes
504.3	Ramp Design Speed	504.4	Freeway-to-freeway Connector Lane Drop Tapers
504.3	Ramp Lane Drop Taper	504.5	Auxiliary Lanes
504.3	Ramp Lane Drops and Auxiliary Lanes	504.6	Mainline Lane Reduction at Interchanges
504.3	Metered Single-Lane Entrance Ramps Auxiliary Lane	504.7	Weaving Sections
504.3	Metered Multi-Lane Entrance Ramps Auxiliary Lane	504.7	Weaving Length
504.3	Ramp Terminals and Grade	504.8	Access Control at Ramp Terminal
504.3	Ramp Terminals and Sight Distance	<b>CHAPTER 600 PAVEMENT STRUCTURAL SECTION</b>	
504.3	Free Right Turns at Ramp Terminals	<b>Topic 602 Pavement Service Life and Traffic Data</b>	
504.3	Distance between Ramp Intersection and Local Road Intersection	Index 602.2	Pavement Service Life for Temporary Pavements and Detours
504.3	Entrance Ramp Lane Drop	<b>CHAPTER 700 MISCELLANEOUS STANDARDS</b>	
504.3	Single-Lane Ramp Widening for Passing	<b>Topic 701 Fences</b>	
504.3	Two-lane Exit Ramps	Index 701.2	Fences on Freeways and Expressways
504.3	Two-lane Exit Ramps and Auxiliary Lanes	<b>CHAPTER 900 LANDSCAPE ARCHITECTURE</b>	
504.3	Distance Between Successive On-ramps	<b>Topic 902 Planting design standards</b>	
504.3	Distance Between Successive Exits	Index 902.2	Sight Distance and Safety Requirements for Planting
504.4	Freeway-to-freeway Connections Design Speed	902.2	Clear Recovery Zone and Trees
504.4	Profile Grades on Freeway-to-freeway Connectors	902.2	Minimum Setback of Trees
504.4	Single-lane Connector Design	<b>Topic 904 Vista Point Design Standards</b>	
504.4	Single-lane Connector Widening for Passing	Index 904.3	Vista Point Connection Design
504.4	Volumes Requiring Branch Connectors		
504.4	Merging Branch Connector Design		
504.4	Diverging Branch Connector Design		